

**Remarks/Arguments**

Applicants are hereby requesting continued examination of this application in accordance with the amendments and remarks contained herein below.

This is in response to the Office Action issued on 12/29/2005 with claims 1-21 pending in the Application. By this response to the Office Action, new claims 21-27 have been added. Claims 1-27 remain in consideration.

Though no objection was raised, Applicants are providing amendment to paragraphs [0036], [0037] and [0052] to provide missing serial number information and remove attorney docket numbers.

Claims 1-20 were provisionally rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-7 and 11-12 of co-pending U.S. Patent Application No. 10/779,558. Applicants are prepared to timely execute a terminal disclaimer to overcome the examiner's rejection.

Claims 1-4 and 11-20 were rejected under 35 U.S.C. § 102(b) as being anticipated by USPN 5,833,570 to *Tabata*, et al. (hereafter *Tabata et al.*). Claim 21 was rejected as being unpatentable over *Tabata et al.* in view of USPN 5,931,757 to Schmidt (hereafter Schmidt). Claims 5-10 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitation of the base claim and any intervening claims.

Applicants appreciate the recognition of patentable subject matter in claims 5-10. Applicants have amended claim 5 to include all of the limitations of base claim 1 as originally presented. Such amendment is believed to place claim 5 in condition for allowance. Claims 6-10 all depend directly or indirectly through intervening claims to presently amended claim 5 and are believed to be in condition for allowance. Claims 11 and 12 have been amended to now depend from presently amended claim 5 and, too, are believed to be in condition for allowance.

Independent claims 1, 13 and 18 have been amended to more particularly point out and distinctly claim the subject matter which Applicants regard as their invention. Applicants respectfully request entry of these amendments and examination of the presently

GMC3149

11 of 18

amended claims 1, 13 and 18 further in view of the following clarifying remarks.

The present invention relates to synchronous shift control in an electrically variable transmission or EVT. The EVT has an input and an output and is capable of a variety of operations - for example, fixed-ratio and multiple mode operations. In fixed-ratio operation, a pair of engaged or applied clutches establishes a mechanical coupling from the input to the output at a fixed ratio. When a clutch is applied, the slip speed thereacross is of course always zero. In a first mode operation, however, wherein one of the clutches is applied and the other clutch is released, the input to output is coupled through one geartrain but exhibiting a continuously variable ratio. In a second mode operation wherein the clutch states are reversed, the input to output is coupled through a different geartrain but still exhibits a continuously variable ratio. In other words, in mode operation the input to output speed ratio is variable. Different geartrains are used to provide different transfer characteristics through the EVT. The actual speed ratio in mode operation is determined in accordance with electric machine speed and torque. In mode operation, slip speed across an applied clutch is of course zero and slip speed across a released clutch is variable. The transmission is said to be synchronous when slip speed across both clutches is zero. Having multiple mode operations available provides opportunity to select which mode to operate in. To minimize torque disturbances when switching between mode operations, motor torque is used to control slip speed across the released clutch to zero and the transmission is synchronous and the torque required to maintain the slip speed at zero across the released clutch comes from motor torque. At this point, the transmission is synchronous but is not in fixed-ratio operation. While at zero slip speed, the clutch can be applied without introducing a torque disturbance. With both clutches applied, the transmission is synchronous and in fixed-ratio operation. Completion of the mode to mode shift is then accomplished by similarly releasing the appropriate one of the clutches while controlling the slip speed thereacross via motor torque control. When the clutch is released and the slip speed is controlled to zero by the motor torque, the transmission is once again synchronous. Subsequently, the actual speed ratio may now be continuously varied in mode operation.

Independent claims 1, 13 and 18 all recite first and second mode operations of a

GMC3149

12 of 18

multi-mode, electro-mechanical transmission as follows:

first mode operation characterized by simultaneous first torque transfer device applied and second torque transfer device released states wherein the transmission input member is mechanically coupled to the transmission output member through a continuously variable ratio

second mode operation characterized by simultaneous first torque transfer device released and second torque transfer device applied states wherein the transmission input member is mechanically coupled to the transmission output member through a continuously variable ratio

Each mode operation is clearly defined with respect to respective clutch states and continuously variable ratio coupling of the transmission input and output members.

Moreover, independent claims 1, 13 and 18 all recite fixed-ratio operation of a multi-mode, electro-mechanical transmission as follows:

fixed-ratio operation characterized by simultaneous first and second torque transfer devices applied states wherein the transmission input member is mechanically coupled to the transmission output member through a fixed ratio

Fixed-ratio operation is clearly defined with respect to clutch states and fixed ratio coupling of the transmission input and output members.

A method for controlling a mode to mode shift in accordance with the present invention further requires the application of the released clutch while slip speed thereacross is controlled to zero via motor torque adjustment and the subsequent release of the applied clutch while slip speed thereacross is controlled to zero via motor torque adjustment.

Independent claim 1 corresponds to such method and recites:

applying the one of the first and second torque transfer devices which is initially in a released state while controlling slip speed thereacross to substantially zero by adjusting motor torque and thereafter releasing the other one of the first and second torque transfer devices which is initially in an applied state while controlling slip speed thereacross to substantially zero by adjusting motor torque.

A mode to mode shift control in accordance with the present invention further requires a computer based controller and control sequence including a mode motor control wherein during mode operation motor torque controls input speed independent of clutch slip

GMC3149

speed, a shift initiation motor control wherein motor torque controls released clutch slip speed to zero, and a shift completion motor control wherein motor torque controls applied clutch slip speed to zero. Independent claim 13 corresponds to such control and recites:

- a computer based controller for establishing motor torque in accordance with a control sequence including;
- a mode motor control during which said transmission is operating in one of said first and second modes and motor torque is used to control transmission input member speed to a target determined independent of speed across the torque transfer devices,
- a shift initiation motor control during which motor torque is used to control speed across the one of the first and second torque transfer devices which is initially in a released state to substantially zero, and
- a shift completion motor control during which motor torque is used to control speed across the other one of the first and second torque transfer devices which is initially in an applied state to substantially zero.

A method for controlling a mode to mode shift in accordance with the present invention further requires establishing synchronous operation using motor torque control of slip speed to zero, establishing fixed-ratio operation by transferring motor torque to a clutch, and establishing synchronous operation by transferring clutch torque to the motor. Independent claim 18 corresponds to such method and recites:

- establishing synchronous operation of the transmission by using motor torque to control slip across the one of the first and second torque transfer devices which is initially in a released state to substantially zero;
- establishing fixed-ratio operation of the transmission by transferring torque being carried by said at least one motor during synchronous operation of the transmission to said one of the first and second torque transfer devices which is initially in a released state when said one of the first and second torque transfer devices which is initially in a released state has established sufficient capacity to accept said transfer of torque without slipping; and,
- establishing synchronous operation of the transmission by transferring torque being carried by the other one of the first and second torque transfer devices which is initially in an applied state to said at least one motor.

The present and preceding Office Actions state that Tabata et al. discloses an electro-mechanical transmission. However, the transmission disclosed by Tabata et al. is not a multi-mode, electro-mechanical transmission as recited in Applicants' independent claims. Tabata

GMC3149

14 of 18

et al. does not disclose multi-mode, electro-mechanical operation as set forth in the Applicants' claims. The transmission of Tabata et al. is not operative for mode operation as set forth in Applicants' claims wherein mode operations are characterized by continuously variable ratio coupling of a transmission input member and transmission output member. More particularly, as detailed above with respect to the commonality of recitations found in Applicants' independent claims 1, 13 and 18, Tabata et al. fails to disclose first mode operation characterized by simultaneous first torque transfer device applied and second torque transfer device released states wherein the transmission input member is mechanically coupled to the transmission output member through a continuously variable ratio. Likewise, Tabata et al. fails to disclose second mode operation characterized by simultaneous first torque transfer device released and second torque transfer device applied states wherein the transmission input member is mechanically coupled to the transmission output member through a continuously variable ratio.

The present and preceding Office Actions also state that Tabata et al. discloses for controlling the shifting of transmission through a plurality of modes (i.e. a multi-mode transmission). However, as demonstrated immediately above, the modes of Applicants' invention have specific and particular meaning and characteristics which are not shared by the transmission apparatus of Tabata et al. And, the modes referred to in Tabata et al. are not equivalent to the modes in the Applicants' invention. Assuming the Office Action refers to the modes of Tabata et al. corresponding to FIG 8 including clutches CE1 and CE2, the modes disclosed in Tabata et al. do not correspond to the modes of the present invention (see above). Nor does Tabata et al. disclose mode to mode shifting between such modes as set forth in Applicants' claims which would require specific slip speed and apply/release control sequences of clutches CE1 and CE2. So, not only does Tabata et al. fails to disclose mode operation as in Applicants' claims (e.g. transmission input member is mechanically coupled to the transmission output member through a continuously variable ratio), it fails to disclose mode to mode shifting as in Applicants' claims (e.g. controlling slip speed across the released clutch to zero by motor torque control, application of that clutch, release of the other clutch, and slip speed control of such releasing clutch to zero by motor torque control).

GMC3149

The present Office Action further states that Tabata et al. discloses controlling or adjusting motor torque while controlling slip speed across an applied oncoming torque transfer device and a released offgoing torque transfer device to substantially zero. And, the present Office Action further identified torque transfer devices referencing sets of clutches from the electrically controlled torque converter 24 (i.e. CE1 and CE2) and from the primary transmission 22 (i.e. C1 and C2). Applicants have pointed out the anticipation deficiencies of applying Tabata et al. to the Applicants' claims relative to the clutches and modes disclosed therein as relate to the electrically controlled torque converter 24 (i.e. CE1 and CE2). In similar fashion, however, the primary transmission 22 (i.e. C1 and C2) of Tabata et al. also fails to anticipate the Applicants' claims in as much as no modes as recited in the claims are disclosed by Tabata et al. The speed ratios associated with the primary transmission 22 (see also FIG. 3) are all fixed ratios and not continuously variable, thus negating any equivalency to Applicants' mode operation. Furthermore, regardless of the immediately prior "mode" deficiency, Tabata et al. fails to disclose mode to mode shifting as set forth in Applicants' claims which would require specific slip speed and apply/release control sequences of clutches C1 and C2 of the primary transmission 22. So again, not only does Tabata et al. fails to disclose mode operation as in Applicants' claims (e.g. transmission input member is mechanically coupled to the transmission output member through a continuously variable ratio), it fails to disclose mode to mode shifting as in Applicants' claims (e.g. controlling slip speed across the released clutch to zero by motor torque control, application of that clutch, release of the other clutch, and slip speed control of such releasing clutch to zero by motor torque control).

Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration. W.L. Gore & Associates. v. Garlock, Inc., 721 F.2d 1540 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). However, it is not enough that that the prior art reference merely disclose all of the claimed elements. Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, arranged as in the claim. Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co., 730 F.2d 1452, 1458 (Fed. Cir. 1984). The identical invention must be shown in

GMC3149

as complete detail as is contained in the claim. Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989). Anticipation must be based on a single reference that describes the subject matter claimed in the patent with sufficient detail and clarity to demonstrate that the subject matter existed and that a person of ordinary skill in the art would have recognized its existence in the asserted prior art reference. ATD Corp. v. Lydall, Inc., 159 F.3d 534, 545 (Fed. Cir. 1998).

Applicants have demonstrated above that Tabata et al. fails to meet the requirements of anticipation in as much as each element of the claims is not found therein arranged as in the claims nor in as complete detail as contained in the claims. Tabata et al. also fails to describe the subject matter of Applicants' claims with sufficient detail and clarity to demonstrate that the claimed subject matter existed and that a person of ordinary skill in the art would have recognized its existence in Tabata et al.

In summary, each of the independent claims 1, 13 and 18, particularly in view of the amendments made thereto in this response, are not anticipated by Tabata et al. Applicants respectfully request the Examiner's concurrence, withdrawal of the anticipation rejections and allowance of claims 1, 13 and 18. For the same reasons expressed above with respect to claims 1, 13 and 18, and further in view of the additional respective limitations of claims 2-4, 14-17, and 19-27 which each directly or indirectly depend from one of independent claims 1, 13 and 18, Applicants respectfully request the withdrawal of all outstanding anticipation and obviousness objections as apply to claims 2-4, 14-17, and 19-27. Applicants respectfully request that all pending claims 1-27 be allowed to proceed to issue.

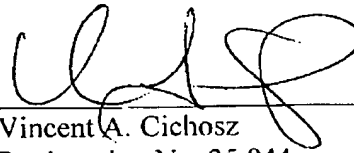
If the Examiner has any questions regarding the contents of the present response he may contact Applicant's attorney at the phone number appearing below.

Any fees associated with this response may be charged to General Motors Deposit Account No. 07-0960.

GMC3149

17 of 18

Respectfully submitted,

A handwritten signature in black ink, appearing to read 'V. Cichosz', is written over a horizontal line.

Vincent A. Cichosz  
Registration No. 35,844  
Telephone: (248) 676-2798

GMC3149

18 of 18